MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

DCA5038 – NETWORK ANALYSIS

(Diploma in Electronics Engineering)

1 JUNE 2017
9:00 a.m – 11:00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 5 pages (5 pages with 5 questions and an appendix).
2. Answer ALL questions. All necessary working steps must be shown.
3. Write all your answers in the answer booklet provided.

QUESTION 1 [20 marks]

Figure 1 shows an electric circuit network and its tree diagram.

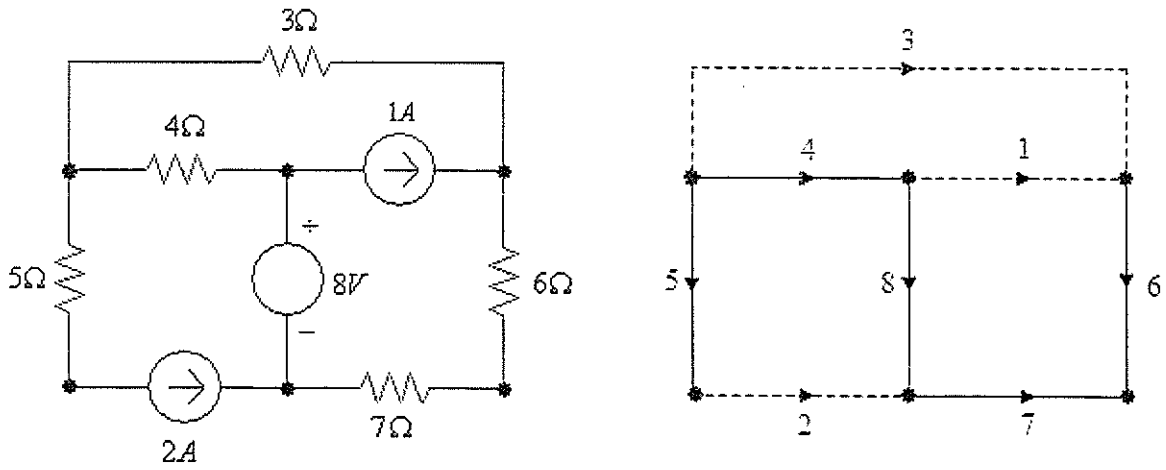

Figure 1

Find all the voltage and current for each edge of the tree using **f-cutset method** only. Write the answer for each current and voltage of the edges up to 3 decimal points neatly in a row.

(20 marks)

Continued...

QUESTION 2 [20 marks]

(a) For signal in Figure 2, shows all the steps to plot its even and odd components.

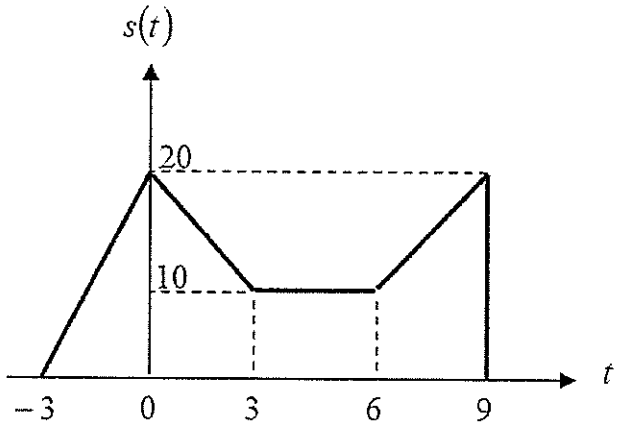

Figure 2

(14 marks)

(b) Sketch the signal $u(t-12)+4u(t)$

(3 marks)

(c) Sketch the signal, $P_{\Delta}(t+12)$

(3 marks)

Continued...

QUESTION 3 [20 marks]

Figure 3 shows a series RL circuit. Initially the switch is set at position 1 for a long time to establish a steady state condition where the initial current, $i_0 = 2A$. Then, at $t = 0$, the switch is change to position 2. Calculate the current in the circuit when the switch is at position 2.

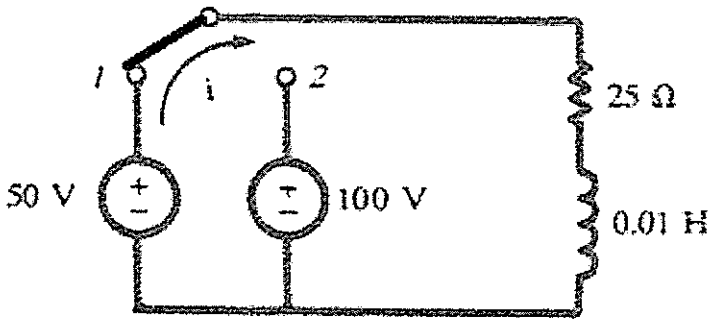

Figure 3

(20 marks)

Continued...

QUESTION 4 [20 marks]

(a) Figure 4(a) shows a T-network diagram. Calculate the Z-parameter and draw the Z-parameter equivalent circuit.

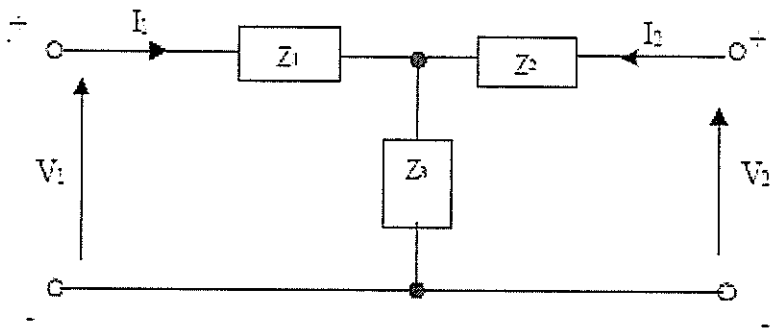

Figure 4(a)

Given $Z_1 = (1 + j2)\Omega$;
$Z_2 = 2\angle -90^\circ\Omega$;
$Z_3 = (8 + j9)\Omega$.

(10 marks)

(b) Figure 4(b) shows a π-network diagram. Calculate the Y-parameter and draw the Y-parameter equivalent circuit.

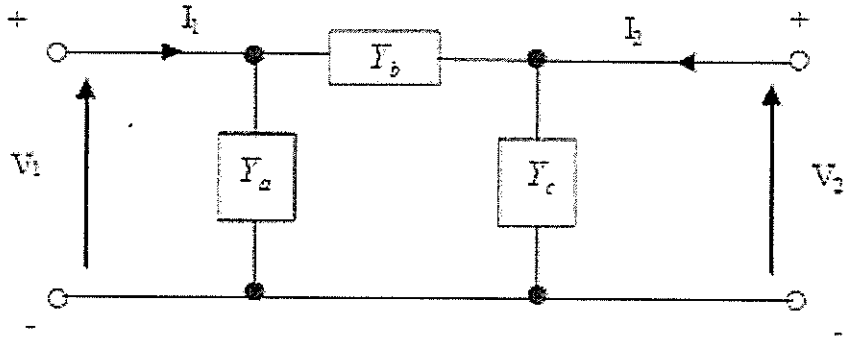

Figure 4(b)

Given $Y_a = 0.1S$;
$Y_b = 0.5S$;
$Y_c = 0.8S$.

(10 marks)

Continued...

QUESTION 5 [20 marks]

(a) Find whether the given function is a Hurwitz polynomial. Relate the Routh-Hurwitz Criterion to determine if the polynomial is strictly Hurwitz.

$$P(s) = s^4 + 16s^3 + 86s^2 + 176s + 105$$

(10 marks)

(b) Determine the network for the following expression by using Cauer first form.

$$Z(s) = \frac{s^4 + 4s^2 + 3}{4s^3 + 10s}; \text{ for an LC network}$$

(10 marks)

End of Page.

APPENDIX

$$\beta_k = \frac{1}{k!}\left(\frac{d^k}{ds^k}\right)\left[(s+a)^r F(s)\right]_{s=-a}$$

TABLE OF LAPLACE TRANSFORM PROPERTIES

$f(t)$	$F(s)$
$\delta(t)$	1
$u(t)$	$\frac{1}{s}$
$tu(t)$	$\frac{1}{s^2}$
1	$\frac{1}{s}$
t	$\frac{1}{s^2}$
t^n	$\frac{n!}{s^{n+1}}$
e^{at}	$\frac{1}{s-a}$
$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$
$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
$e^{-at} \sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$
$e^{-at} \cos \omega t$	$\frac{(s+a)}{(s+a)^2+\omega^2}$

$t\sin\omega t$	$\frac{2s\omega}{\left(s^2+\omega^2\right)^2}$
$Af(t)$	$AF(s)$
$f_1(t)\pm f_2(t)$	$F_1(s)\pm F_2(t)$
$f(at)$	$\frac{1}{a}F\left(\frac{s}{a}\right)$ where, $a>0$
$f(t-t_0)u(t-t_0)$	$e^{-t_0 s}F(s)$
$f(t)u(t-t_0)$	$e^{-t_0 s}L[f(\lambda+t_0)]$
$e^{-at}f(t)$	$F(s+a)$
$\frac{d^n F(s)}{dt^n}$	$s^n F(s)-s^{n-1}f[0]-s^{n-2}f^2[0]....s^n f^{n-1}(0)$
$tf(t)$	$-\frac{dF(s)}{ds}$
$\frac{f(t)}{t}$	$\int_s^\infty F(\lambda)d\lambda$
$\int_s^\infty f(\lambda)d\lambda$	$\frac{1}{s}F(s)$
$\int_s^\infty f_1(\lambda)f_2(t-\lambda)d\lambda$	$F_1(s)F_2(s)$

SYNTHESIS OF LC NETWORK

The partial fraction expansion of an LC function using First Foster form:

$$F(s)=\frac{K_0}{s}+\frac{2K_2 s}{(s^2+\omega_2^2)}+.....+K_\infty s$$

SYNTHESIS OF RC & RL NETWORK

The partial fraction expansion of an RC function using First Foster form:

$$Z(s)=\frac{k_0}{s}+\frac{k_2}{(s+\sigma_2)}+\frac{k_4}{(s+\sigma_4)}+k_\infty=\frac{k_0}{s}+\sum_{i=2,4,6}^{n}\frac{K_i}{(s+\sigma_i)}+k_\infty$$